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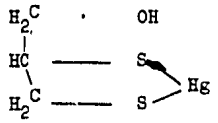
DIMERCAPTOPROPANOL PREPARATIONS AS DETOXICANTS IN ARSENIC AND HEAVY METAL POISONINGS

A. Mosig

Dithioglycerin "Rodleben" manufactured by the Hydrierwerke Rodleben VEB (People-Owned Enterprise) is one of the more recent pharmaceuticals. It is used intramuscularly in a 5% oil solution to treat intoxication with arsenic and/or heavy metals, such as Hg, Cu, Zn, and Pb. It is also used in the treatment of hepatitis and Werlhof's disease (purpura hemorrhagica Werlhof, diminution of the number of blood platelets).

Dithioglycerin "Rodleben," Sulfactin "Homburg," and Bal (British anti-lewisite) have the same chemical composition, namely 2, 3-dithioglycerin (dimercaptopropanol). Dimercaptans of this type can form, both with arsenic compounds in which the arsenic is present in the trivalent form and with a number of heavy metals, a stable compound with a five-membered ring:



Dithioglycerin has the following characteristics:

1. It is a colorless oil with a penetrating odor. This oil readily dissolves in organic solvents, but is slow to dissolve in H_2O. The S content is 51.6 percent.

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2. It has the following physical properties:

Boiling point (0.9 mm Hg)	91 to 92°C
Density at 20°	1.2415
Refraction index n_D^{20}	1.5714

3. A solution of 2, 3-dithioglycerin in alcohol, after the addition of an aqueous lead acetate solution, immediately produces a yellow precipitate of Pb-dithioglycerin which dissolves with great difficulty.

The following reactions were obtained by adding one cubic centimeter of a mixture of 5 cc alcohol and 2 cc of a 5% dithioglycerin solution in oil to:

	Precipitate
5 cc of an aqueous 10% lead acetate solution	Yellow
5 cc of an aqueous 5% sublimate solution	white
5 cc of an aqueous 5% cuprie sulfate solution	dark blue
5 cc of an aqueous 10% zinc sulfate solution	gray white
5 cc of an aqueous 10% nickel sulfate solution	dark brown
2.5 cc of liquor kalii arsenicosi	white
1 cc of an aqueous 10% calcium chloride solution	milkiness
5 cc of Nylander solution	yellow
A solution of 0.5 g bismuth subnitrate (subnitricum) in 5 cc of nitric acid + 5 cc of water	yellow

Dithioglycerin is prepared by adding bromine to allylalcohol and subsequent conversion of the dibrompropanol with sodium hydrosulfide into 2, 3-dithioglycerin. Due to its two sulfhydryl groups, dithioglycerin has a great affinity for arsenic and heavy metals, an affinity which is stronger than that of the sulfhydryl groups of the proteins and enzymes of the living organism. Hence any compound of arsenic or of a heavy metal with proteins or enzymes will be broken up by the dithioglycerin. The sulfhydryl groups are released, while the arsenic or heavy metal forms a stable compound with the dithiolglycerin, which, only slightly toxic, is eliminated with the urine. Similar detoxifying reactions are produced by cysteine, glutathione, and thiosulfates, but 2, 3-dithioglycerin is more effective.

The 2, 3-dimercaptopropanol acts as a strong reducing agent in connection with oxidation processes of the organism and therefore has a certain toxicity of its own.

Klumbies (fnu) [1_7 reports that a small (1.5 mg/kg of body weight) therapeutic dose of dithioglycerin "Rodleben" has given good results. This would amount to approximately 0.1 g per adult dose and corresponds to the contents of an ampule holding 2 cc of a 5% oil solution. Foreign literature reports that 3 mg of BAL per 1 kg of body weight are well tolerated.

2, 3-dithioglycerin has been found to be a most effective remedy in cases of lewisite poisoning; in serious cases of arsenic poisoning, such as overdoses given in the treatment of syphilis, or poisoning of workers in industrial plants; mental disturbance following Salvarsan treatment; mercury and lead poisoning; and in cases of dermatitis due to the administration of gold. According to several observers, this drug seems to be contraindicated in liver and kidney ailments, although the results were satisfactory in epidemic hepatitis.

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Recent observations [2] show that dimercaptopropanol has a detoxicating effect not only for poisoning from arsenic, antimony, and metal compounds, but also for poisoning from avertin, hydrocyanic acid, bacterial toxins (diphtheria and tetanus), and snake venom.

Experience outside of Germany with BAL and inside Germany with Sulfactin "Homburg" and dithioglycerin "Rodleben" proves without a doubt that at present dimercaptopropanol is the most effective detoxicant for heavy metal and arsenic poisonings, and a life saver if used in time.

Some reports indicated that the calcium level of the blood is lowered after treatment with dimercaptopropanol. The author carried out some preliminary experiments with two rabbits and found that the calcium level, instead of being lowered, was increased slightly. There may be an analogy to the findings of Telfer and Randle [3] regarding the use of dimercaptopropanol in lead poisoning.

As a preliminary contribution to the study regarding the ability of dimercaptopropanol to form [relatively stable] compounds with bacterial toxins, the author investigated the effect of the drug on mice infected with tetanus toxin. The mice, subcutaneously injected with tetanus toxin, were given intramuscular injections of 0.25 mg of dimercaptopropanol immediately following the tetanus toxin and again within 3, 7, 24, 28, and 32 hrs. There was no beneficial effect.

Experiments to establish whether or not the pharmaceutical can form [stable] compounds with snake poisons have not been completed.

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1. Klumbies, D. D. Ges., No 35, 1952

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3. Randle, J. Amer. Med. Assn., Vol 135, No 12/13, 1947

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